

WEB EDITION OF THE METAMORPHIC MAP AND DATABASE OF CARPATHO-BALKAN-DINARIDE AREA

(<http://www.uni-tuebingen.de/geo/met-map/index.html>)

I. DUNKL, P. ÁRKAI, D. BALEN, I. BALINTONI, T. BERZA, A. BIROŇ,
L. CSONTOS, W. FRISCH, H. FRITZ, L. HOXHA, M. JANÁK, M. KÁZMÉR,
F. KOLLER, B. KOROKNAI, Gy. LELKES-FELVÁRI, D. MILOVANOVIC,
Th. MOST, T. M-TÓTH, R. NAKOV, L. PALINKAŠ, J. PAMLÆ, D. PLAŠIENKA, A.
PUSTE, M. PUTIŠ, R. SCHUSTER, B. SZÉKELY, M. THÖNI,
B. TOMLJENOVÆ, K. TÖRÖK and M. VRABEC

Format convention:

Courier: author of the system - defined in chapter: "Authors of the Main map..."

Italics: part of the system - defined in chapters: "Parts of the system" and "Units of the Main maps"

I. Introduction, goals

It is twenty-five years ago that the 'Map of Metamorphites of the Carpatho-Balkan-Dinaride Area' was published within the frame of the Commission on Magmatism and Metamorphism of the Carpatho-Balkan Geological Association, by co-authors from eight countries (Szádeczky-Kardoss et al., 1976). The technical editing work was made at the Laboratory for Geochemical Research of the Hungarian Academy of Sciences by Péter Árkai. During the past decades the knowledge on the metamorphic evolution of this region was multiplied, owing to the appearance of new methods in thermobarometry and in geochronology. Numerous new deep drillings have reached the metamorphic basement of the areas covered by Neogene sediments, serving new information on the subsurface distribution of metamorphic formations.

Recently, the community of Alpine geologists published the 'Metamorphic Map of the Alps' (Frey et al., 1999) which summarises the metamorphic evolution of the most important adjacent area.

We consider that the time has arrived to compile a new metamorphic map of the Carpatho-Dinaride-Balkan area. Geoscientists working in the region are already utter the wish after a modern, consistent and easy-to-read map which integrates the data from different countries.

In this initiative we aim to develop and co-ordinate a new map and a database considering the metamorphic formations of the European Alpine chain between the Alps s. str. and the Anatolides. The new Met-Map will consider formations experienced at least "very low grade" metamorphism ($>2.5\text{-}3\%$ vitrinite reflectance [R_{random}] and/or $< 0.42^\circ \Delta 2\theta$ illite crystallinity).

II. Philosophy, accessibility

— This map is planned to be essentially different from its precursor and from the Alpine map. It will be a web-site based map with linked textual data and a discussion forum on its homepage. (Later, for the better distribution, CDs will also be created and when all the *Descriptions* will be ready, a joint printed publication is also possible.)

- The map consists of *Units*. The *Units* are characterised by the latest metamorphic overprint. Within one *Unit* the metamorphic grade can vary. Their textual and graphical (i) definition, (ii) description of metamorphic events and their characters, mineral assemblages, pT conditions, (iii) bibliography and (iv) a *Pin-board* are linked to every *Unit*.
- One benefit of this way of editing is that the map and the attached database will be updated permanently, thus the data will always mirror the latest stage of research.
- There is an other advantage: no expenses of commercial printing and distributing will appear. Every user can download the last versions of the graphic and text files and print the map by own desktop printer.

III. Parts of the system (on the web-page)

1. Textual information on the whole system
 - 1.1. Important notice (read me first: copyright, data availability, downloading instructions).
 - 1.2. The "Constitution" of the Met-Map.
 - 1.3. List of authors with affiliation, address and e-mail.
 - 1.4. Table of *Units* (name; age and grade of metamorphism; compilers; e-mail to Responsible Compiler).
2. Overview maps
 - 2.1. Map of the *Units*.
 - 2.2. Tectonic map of the *Boundaries*.
 - 2.3. Position of detailed maps.
3. Main maps
 - 3.1. Map of Alpine metamorphism. (Four sheets of 1:1,000,000 scale. Tiles are downloadable in GIF format with a resolution of 300 dpi.)
 - 3.2. Map of Variscan and pre-Variscan metamorphism. (Four sheets of 1:1,000,000 scale. Tiles are downloadable in GIF format with a resolution of 300 dpi.)
 - 3.3. Legend of the *Main maps*.
4. Textual characterisation of the *Units*
 - 4.1. *Description* (text, tables and figures) made by the *Compilers*.
 - 4.2. *Pin-board* (text and figures related to the *Units*).
 - 4.3. Submission interface for the *Pin-board Articles*. These records can be submitted by any person.
 - This subsystem is dealing with papers specifically sent to explain or discuss features (data, observations, measurements, concepts) of a *Unit* or an area composed of several *Units*. These contributions are expected to be in a compact, article-like form without the complex requirements of a paper article.
 - Alternative opinions can be presented also here, which were not accepted by the *Compilers* of the *Unit(s)*. Use objective and moderate style, please.
 - It also serves as a forum for announcements (new measuring techniques, new projects, Ph.D. posts, proposals, reviews, applications, etc.).
 - 4.4. *Editorial Notes* are placed by the *Editor*. These small comments can link remarkable *Pin-board Articles* to different parts of the Met-Map and should indicate contradictions between *Pin-board Articles* and *Descriptions*.

IV. Main maps

Base map

The topographical base and the presented area of the map is identical with the Carpatho-Balkan-Dinaride map (Szádeczky-Kardoss et al., 1976).

Layers for orientation

Geographic grid

One-degree latitude and longitude grid.

Hydrography

Coastlines, lakes and rivers.

Topography

Settlements (> 100,000) and state boundaries.

Geological content

Subdivision

The *Main maps* are composed of *Units* (see below). The *Units* are separated by *Boundaries*. The subdivision created for "Map of Alpine metamorphism" is used also for the "Map of Variscan and pre-Variscan metamorphism".

Data reliability

The content of the *Main maps* (both the *Boundaries* and the *Units*) are considered and presented in three reliability levels:

- Facts,
- Interpreted, supposed,
- Unknown (indicated by question-marks and by gray colour).

Generalisation

The suggested minimum size of distinct objects are 2 to 3 mm on the *Main maps*. That refers to geological objects of 2 to 3 km in real size.

- Complicated *Boundaries* and spotted occurrences of a *Unit* need simplification.
- Occurrences of *Units* with small size (lamellae, remnants of nappes) require enlargement to the suggested minimum size.

Categories according to the age of metamorphism

The time scale of Harland et al. (1989) is considered.

Horizontal stripes: uncertainty or results indicating two age groups.

Vertical stripes: two distinct and identified metamorphic phases.

— Map of Alpine metamorphism

Areal symbols

- Triassic to Early- Jurassic ages (from 245 to 160 Ma mica or amphibole K/Ar or Rb/Sr cooling or formation ages),
- Late Jurassic-Early Cretaceous (ages between 160 and 110 Ma),
- Late Cretaceous (ages between 110 and 65 Ma),
- Tertiary (ages < 65 Ma),
- No Alpine metamorphism,
- Supposed (no borehole reached metamorphic formations, but the given area is evidently a part of a *Unit*),
- Unknown (usually below thick unmetamorphosed cover).

Point-like symbols

- If a *Unit* contains scattered geochronological results which are considerably younger/older than the characteristic metamorphic age of the

Unit, these individual data points (or a generalised cluster of them) can be placed on the map (see *Legend* on the homepage). Such a scenario is not uncommon, for example Tertiary ages occur (mainly along shear zones) in many areas dominated by Cretaceous metamorphism.

— Permian, Triassic and Jurassic crustal-scale extension (rifting) is expressed by thermochronometric data and these thermal events are not represented by "classical" dynamothermal metamorphism. If the extent of these areas are not significant their point-like presentation is suggested (see *Legend* on the homepage).

— Map of Variscan and pre-Variscan metamorphism

Areal symbols

- Pre-Variscan (> 400 Ma),
- Variscan (400-300 Ma),
- Permian (300-245 Ma),
- No Pre-Alpine metamorphism,
- Unknown (below thick sedimentary cover or overprinted by high grade Alpine metamorphism).

Categories according to metamorphic grade (within the age categories)

Areal symbols

- Subgreenschist facies metamorphism,
- Greenschist facies metamorphism,
- Amphibolite facies metamorphism,
- Blueschist facies metamorphism.

Point-like symbols

- Occurrence of eclogite facies metamorphism,
- Occurrence of granulite facies metamorphism.

V. Units of the Main maps

— The *Units* are the building stones of the *Main maps*, they make a complete coverage of the presented area.

— They are characterised by their latest metamorphic overprint.

— Every *Unit* has a name.

— They have a closed shape on the *Main maps*.

— The *Boundaries* are defined and separating *Units* of distinct metamorphic histories.

— Every *Unit* has a *Description*.

— A *Description* is considered as a publication.

VI. Description of the Units

The planned structure of the descriptions composed of the following chapters:

Definition

Geographic Position

Maps

Boreholes

Boundaries

Structural Position
Subunits
Correlation
Age of Protolith, Geochemistry
Lithology, Mineralogy, Metamorphic Grade
Thermobarometry
Geochronology
Structural Evolution
Summary
Bibliography
Links (to neighbouring *Units* and other parts of the system)

VII. Authors of the Met-Map and their role

Editor

- Keeps contact with the Editorial Board and the Compilers of the *Descriptions*.
- Checks the submitted materials. If the *Description* of a *Unit* does not fit to the neighbouring ones, contacts the Compilers and with the Editorial Board manages a consensus according to coherent criterion.
- Creates and actualises the overview maps, tables, lists and links of the homepage. Performs the updating of the graphic and textual information on the web-pages from the received materials. The map details are placed on the public web-site, only when the Responsible Compiler already confirmed it.
- The Editor can point out serious contradictions between *Descriptions* and *Pin-board Articles* with *Editorial Notes*.

Editorial Board

- Composed of National Representatives and persons contributing to the creation of *Boundaries*.
- With the Editor create the subdivision of the map into *Units*.
- Receives suggestions to modify the *Boundaries* of the *Units* or to unify/split the *Units* into parts.
- Gives mandate to the Compilers to create the *Descriptions* of the *Units*.
- Checks the submitted *Descriptions* according to the required parameters (e.g. every obligatory record must be filled). If it does not fulfil the criterion, they return it to the responsible Compiler, otherwise the *Description* is forwarded to the Editor.
- The Editorial Board does not modify the content of the *Description*, just notices the observed contradiction with the bordering *Units*.

Compilers

- They are responsible for the *Descriptions*.
- *Units* crossing political borders must have at least one Compiler from each country.
- They can select and ask additional Compiler(s) for the creation of a given *Description*.
- The Responsible Compiler traces the life of the *Description* and modifies its content when new, significant data appear and updates the bibliography by the new, related publications.

— Later, when the *Description* is already presented on the Met-Map homepage they receive the suggestions to complete/modify (i) the description of a *Unit*, (ii) and if it is necessary to change pattern and symbols of the *Unit* on the *Main maps*.

Contributors

If the `Compilers` accept the suggestions they modify the *Description* and send it to the `Editorial Board`. In this case the person(s), who submitted the suggestion become `Contributor` and their name(s) will be mentioned in the *Description*, further in the "header file" of the *Unit*.

References

- Frey, M., Desmons, J. and Neubauer, F. (1999): The new metamorphic map of the Alps: Introduction. *Schweizerische Mineralogische und Petrographische Mitteilungen*, 79, 1-4.
- Harland, W. B., Armstrong, R. L., Cox, A. V., Craig, L. E., Smith, A. G. and Smith, D. G. (1989): *A Geologic Time Scale 1989*. Cambridge University, Cambridge, 263 p.
- Szádeczky-Kardoss, E., Árkai, P., Balázs, E., Beck-Manngetta, P., Bercea, I., Boyadijev, S. G., Danilovich, Yu. R., Dimitrievă, M., Giuscã, D., Juhász, Á., Kamenický, J., Karamata, S., Kräutner, H., Kovách, Á., Nagy, E., Ravasz-Baranyai, L., Savu, H., Semenenko, N. P., Szederkényi, T., Szalay, Á., Štelcl, J., Tkachuk L. G., Wieser, T. and Weiss, J. (1976): *Map of metamorphites of the Carpatho-Balkan-Dinaride area, 1:1,000,000*. Published by the Laboratory for Geochemical Research of the Hungarian Academy of Sciences and the Central Office of Geology, Hungary.